Appendix B

GUIDELINES AND FORM FOR PETROLEUM GEOLOGIC PROBABILITY ANALYSIS

This appendix presents definitions of terms, procedural guidelines, and the form used to perform and document the petroleum geologic probability analysis (see *Methodology* section) of 46 petroleum geologic plays of the Pacific OCS Region. The minimum accumulation size considered in the probability analysis is 1 MMbbl of combined oil-equivalent resources.

DEFINITIONS AND GUIDELINES

Play Chance is the probability that at least one accumulation of conventionally recoverable hydrocarbons exists in a play. It reflects the chance for success at the group (play) level.

To estimate the Play Chance:
• For each element (a_1, a_2, etc.) of a play-level component (A), assign a *qualitative* probability of success (very poor, poor, fair, good, very good, excellent, or assured), according to the guidelines in table B1.
• Circle the critical factor(s) that would significantly limit success at all prospects in the play.
• For each component (A, B, etc.), assign a *quantitative* probability of success (between zero and one, where zero indicates no chance and one indicates absolute certainty) based on consideration of the qualitative assessment of ALL elements within the component, according to table B1. This assignment should be based primarily on the critical factor(s) and secondarily on the noncritical factor(s).
• Multiply the three component success values (A, B, C) to estimate the Play Chance. Round the computed value to one of the values in table B1.

Table B1. *Guidelines for assigning petroleum geologic probabilities of success.*

Qualitative Probability	Description	Quantitative Probability
Assured	The factor is known or assumed to be adequate.	1.0
Excellent	The factor is virtually assured to be adequate.	0.95
Very Good	The factor is very probably adequate.	0.8 or 0.9
Good	The factor is probably adequate.	0.6 or 0.7
Fair	The factor may be adequate.	0.4 or 0.5
Poor	The factor is probably not adequate.	0.2 or 0.3
Very Poor	The factor is very probably not adequate.	0.1 or 0.15

Conditional Prospect Chance is the probability that conventionally recoverable resources exist within an individual prospect in the play, given the conditional assumption that at least one accumulation exists in the play (i.e., the play is successful). It reflects the chance for success at the individual (prospect) level. This probability can also be described as a conditional success ratio, i.e., the fraction of all of the prospects (or proportion of the play area) for which a particular Prospect Chance factor is successful, given the conditional assumption that the play is successful.

To estimate the Conditional Prospect Chance:
• For each element (d_1, d_2, etc.) of a prospect-level component (D), assign a *qualitative* probability of success assuming that at least one accumulation exists in the play, according to table B1.
• Underline the critical factor(s) that would significantly limit success at an average prospect in the play.

- For each component (D, E, etc.), assign a *quantitative* probability of success based on consideration of the qualitative assessment of ALL elements of the component, according to table B1. This assignment should be based primarily on the critical factor(s) and secondarily on the noncritical factor(s).
- Multiply the three component success values (D, E, F) to estimate the Conditional Prospect Chance. Round the computed value to one of the values in table B1.

Average Prospect Chance is the probability that conventionally recoverable resources exist within an individual prospect in the play, with consideration of the probability that at least one accumulation exists in the play. It reflects the combined chance for success at the group (play) and individual (prospect) levels.

To estimate the Average Prospect Chance:
- Multiply the Play Chance (G) and the Conditional Prospect Chance (H) values. Round the computed value to two significant digits.
- Compare the computed Average Prospect Chance to some typical success ratios in table B2. Note that many cited success ratios represent economic success and that geologic success ratios should be greater. If the computed Average Prospect Chance is not reasonable or defensible, revise the Play Chance and/or Conditional Prospect Chance.

or
- Compute and apply a success ratio from a geologically analogous area. The analog success ratio may be modified to account for less-than-complete analogy between the areas.

Table B2. *Typical success ratios for petroleum exploration.*

Source	Description	Success Ratio
White (1993)	... many wildcat success ratios range from ...	0.10 to 0.40
White (1993)	... typical plays with reasonable source-reservoir-trap conditions ...	0.25
Simmons (1990)	1969-1981 U.S. average success ratio for all exploratory wells (including step-out wells in known fields)	0.261
Simmons (1990)	1969-1981 U.S. average success ratio for "new field wildcats"	0.153
MMS (1995a)	1973-1991 U.S. average success ratio for exploratory wells	0.256
MMS (1995b)	Success ratio of Santa Maria basin OCS exploratory wells	0.70

REFERENCES

Minerals Management Service, 1995a, Unpublished computations by the Minerals Management Service of success ratios for exploration wells drilled in the United States, using information compiled by the Energy Information Administration.

Minerals Management Service, 1995b, Unpublished study of exploratory wells in the Federal offshore portion of the Santa Maria basin.

Simmons, M.R., 1990, Our upcoming domestic embargo?, Panel discussion on National Energy Strategy: Slides and notes for a presentation to OCS Policy Committee Meeting, May 23, 1990, Anchorage, Alaska, 12 p.

White, D.A., 1993, Geologic risking guide for prospects and plays: American Association of Petroleum Geologists Bulletin, v. 77, no. 12, p. 2048-2061.

PETROLEUM GEOLOGIC PROBABILITY ANALYSIS FORM
1995 National Assessment of United States Oil and Gas Resources
Pacific OCS Region

Province: _____

Assessment Area: _____

Play: _____ Play Code: _____

Assessor: _____ Date: _____

For each element (a_1, a_2, etc.) of a component (A), assign a *qualitative* probability of success (very poor, poor, fair, good, very good, excellent, or assured). For each component (A, B, etc.), assign a *quantitative* probability of success (between zero and one, where zero indicates no chance and one indicates absolute certainty) based on consideration of the qualitative assessment of ALL elements of the component.

PLAY CHANCE FACTORS	PETROLEUM GEOLOGIC FACTORS FOR SUCCESS		CONDITIONAL PROSPECT CHANCE FACTORS
A._____	**HYDROCARBON FILL**		D._____
a_1._____	source presence	(adequate organic content, organic quality, & volume of source rock)	d_1._____
a_2._____	maturation	(enough time & temperature for maturation, & adequate volume of mature source rock)	d_2._____
a_3._____	migration	(adequate primary expulsion from source rock, secondary migration to traps, & paleodrainage area of source rock)	d_3._____
a_4._____	preservation	(freedom from flushing, biodegradation, diffusion, or thermal overmaturation)	d_4._____
a_5._____	recovery	(adequate drive, concentration (not too dispersed or diluted), & oil viscosity for effective recovery)	d_5._____
B._____	**RESERVOIR ROCK**		E._____
b_1._____	reservoir presence	(sufficient areal distribution & net thickness of reservoir rock)	e_1._____
b_2._____	reservoir quality	(sufficient porosity, permeability, & continuity of reservoir rock)	e_2._____
C._____	**TRAP**		F._____
c_1._____	trap presence	(adequate area & height of closures)	f_1._____
c_2._____	seal presence	(adequate thickness & lithology of top & lateral seals)	f_2._____
c_3._____	timing	(proper timing of trap formation relative to migration)	f_3._____

A × B × C = **Play Chance for Success =** G._____

D × E × F = **Conditional Prospect Chance for Success =** H._____

G × H = **Average Prospect Chance for Success =** I._____